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U. S. DEPARTMENT OF AGRICULTURE.
BUREAU OF PLANT INDUSTRY—BULLETIN NO. 120.
B. T. GALLOWAY, *Chief of Bureau.*

THE PRODUCTION OF EASTER LILY BULBS IN THE UNITED STATES.

BY

GEORGE W. OLIVER,
PLANT PROPAGATOR, BUREAU OF PLANT INDUSTRY.

ISSUED JANUARY 10, 1908.

WASHINGTON:
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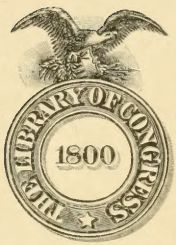

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., October 3, 1907.

Sir: I have the honor to transmit herewith a manuscript entitled "The Production of Easter Lily Bulbs in the United States," by Mr. George W. Oliver, Plant Propagator of this Bureau, and recommend that it be published as Bulletin No. 120 of the series of the Bureau of Plant Industry.

The Easter lily is of great importance to florists, its bulbs being largely imported from Bermuda and Japan. The imported bulbs, however, are not satisfactory, and if the industry of forcing these plants so that they will be in flower at Easter is to be continued it will be necessary to produce the bulbs in this country. The problem of producing these bulbs in the United States has been studied for some years by members of the staff of this Bureau, and the accompanying paper summarizes the information on the subject to date. Mr. Oliver has shown that healthy bulbs can be readily and profitably produced in this country and that disease-resistant strains can easily be maintained.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

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THE PRODUCTION OF EASTER LILY BULBS IN THE UNITED STATES.

DISEASE IN IMPORTED BULBS.

At the present time Bermuda is the main source of supply of Easter lily bulbs for the United States. The mild winter climate of the island is very favorable to the growth of these lilies in the open air, but the area of arable land is limited and many of the farms are so small that alteration of crops is not practiced with lilies, onions, and potatoes, which are the staple crops.

As a result of these conditions and the fact that careful selection is not practiced the vigor of the lily bulbs produced is lessened and weak plants are produced from them. As a consequence the plants grown from Bermuda bulbs in greenhouses in the United States are in a very unsatisfactory condition. In many cases from 50 to 75 per cent of the plants are diseased to such an extent as to be practically unsalable; in fact, they are so seriously affected that many florists would willingly give up their cultivation altogether were it not that their patrons demand the lily in its season. The problem how and where to produce the bulbs within our own borders therefore confronts those who would continue in this industry. That this problem will be solved soon there is little doubt. It is not likely that American growers will be able to harvest the bulbs and place them on the market as early as the Bermuda crop, but judging from present appearances their efforts will result in supplying bulbs practically free from disease.

It is said that about 3,000,000 bulbs are annually imported from Bermuda and that about 20,000 salable bulbs, ranging in size from three to five inches in circumference, can be grown on an acre of ground from mother bulbs planted the preceding year. The second year's crop of bulbs of that size, whether from seedlings or from bulbs, should therefore bring from $1,000 to $2,000 an acre.

PREVIOUS EFFORTS TO ESTABLISH THE GROWING OF EASTER LILY BULBS IN THE UNITED STATES.

During the past decade many attempts have been made by seed firms and others, including the Division of Botany of the Department of Agriculture, to grow the Easter lily commercially in the Carolinas,

Florida, and other States. These efforts were useful in pointing out places where it was evidently impossible to produce bulbs cultivated after the manner now pursued in the Bermudas and Japan.

Both large and small imported bulbs were planted at various places and received the best of care, but in every case the crop when harvested did not warrant a continuation of the experiments. All of these failures resulted partly from unsuitable soils, but principally from unfavorable climatic conditions. It is reasonable to suppose that the lily disease so prevalent in imported bulbs played its part in making the experimental work a failure.

TRIALS OF IMPORTED BULBS IN CALIFORNIA.

The experimental work now being conducted on the Pacific coast promises successful results, but even in that region, favored as it is with nearly ideal conditions in the matter of soil and climate, good results can not be expected by following the old methods of asexual propagation practiced in the Bermudas. This has been shown repeatedly in connection with several large lots of selected imported bulbs planted out in widely different localities for seeding purposes. These plants show the usual amount of disease on the foliage, while the apparently healthy plants propagated by division and by scales also show the disease to such an extent that it seems a difficult matter to get rid of the trouble by purely vegetative methods of reproduction from selected bulbs.

ORIGIN OF THE EFFORT TO GROW SEEDLINGS.

A few years ago Dr. Albert F. Woods, of the Bureau of Plant Industry, in his investigations of the lily disease discovered that seedling plants were practically free from the disease. About the same time Mr. E. M. Byrnes, then connected with the Office of Public Buildings and Grounds, but now with the Bureau of Plant Industry, found that the progeny of crossed varieties were more vigorous than either parent.

At the instigation of Dr. B. T. Galloway the writer grew a large number of seedlings in the Department greenhouses, and from these several pounds of seed resulted. This was distributed on the Pacific coast and in Florida. The seedlings grown in California showed conclusively that with liberal treatment first-class bulbs can be grown by this method much more quickly than by asexual propagation. The plants are almost free from disease. A few plants show it here and there in first generation seedlings, but in the second and third generations it is difficult to find an affected plant. These results have been so encouraging to practical men on the coast that several are now engaged in getting up a stock of seedlings upon a large scale.

THE MOST SUITABLE LOCALITIES FOR LILY BULB GROWING.

Although enough has not been done in an experimental way to ascertain all of the localities where lilies can be grown successfully,

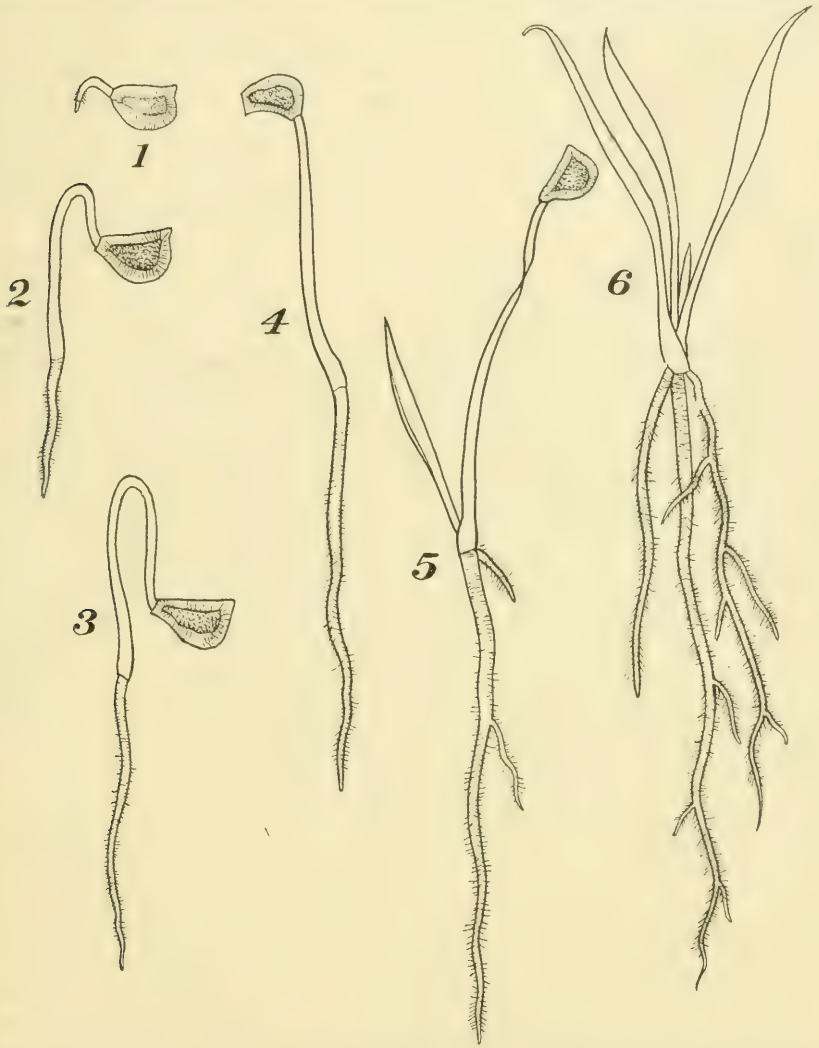

FIG. 1.—Sketches showing the various stages of development in the germination of *Lilium longiflorum*. 1. Sprouting of the seed. 2. An older stage, where the cotyledon shows the bending, while the apex remains closed in the seed absorbing the endosperm. 3. A still older stage. 4. The cotyledon has now unfolded itself, raising the attached seed high above the level of the ground. 5. The first leaf is developed while the cotyledon is as above. 6. The seed has dropped and three leaves are now developed; also two secondary roots. The roots show wrinklings above, indicating their contractile power in drawing the bulblet deeper and deeper into the soil.

it may be stated that the lily seedlings have shown great vigor where the winter temperature does not fall below 24° F. Below that point

the plants get a check to their growth and the foliage puts on an undesirable yellowish tinge, which remains during the winter.

In Florida, seed sent to persons who undertook experimental work has not given good results. The northern and central parts of the State occasionally get much too cold to insure strong winter growth. In the southern part where seed has been sent the reports of those who were experimenting are not very favorable. However, most of those who grew the seedlings were absent during the summer, in which season the growing plants need very close attention. It is possible, therefore, that the failures may be charged to want of attention at critical periods.

At Miami, Fla., the temperature is neither too hot in summer nor too cold in winter for growing bulbs. During the period from September, 1895, to December, 1903, the temperature fell below the freezing point on only two occasions, the lowest being 29° F. Under such circumstances the bulbs will do well provided they receive the necessary attention.

At Key West, Fla., the conditions are ideal, closely approaching those at Bermuda, the extreme range of temperature in thirty-three years being from 41° to 100° F. and the extreme range of precipitation 21.1 to 58.4 inches. On the large keys near the southeastern coast of Florida the seedlings do remarkably well, but the climatic and other conditions during the growing season are such as to practically prohibit good cultivators from locating there.

In the northwestern part of the State of Washington the seedlings do not stand the winter without protection. However, bulbs planted deeply in the fall make fine roots and develop well the following year, making excellent bulbs late in the season, but much too late for early forcing.

In many parts of California, especially in the hot interior valleys, where good soil and plenty of water are available and the winter temperature is not too low, the seedlings thrive well. At Loomis, a few miles northeast of Sacramento, the soil and climate are well adapted to their needs. Some areas in that vicinity are nearly frostless, and the lilies come into flower as early as anywhere in the State, with the possible exception of the foothills near Los Angeles. So far, none of the seedlings have been grown at Loomis, but judging from the growth made by mature bulbs sent for seeding purposes and comparing it with that made in other sections the advantage lies with the Loomis locality. Very little disease was apparent in the foliage, and the flowers were open several days in advance of those from bulbs planted at the same period in the valleys of the southern part of the State.

At several places south of San Francisco selected for experimental work, it was impossible to secure the carrying on of the work necessary for the raising of bulbs from seed. The seed would germinate well (fig. 1), but when it came to planting out the seedlings in spring the farmers and florists could not be brought to believe that it was possible in twelve months' time to raise a flowering plant from a seedling not more than 2 inches high. (See fig. 1, 6.) One firm had 70,000 seedlings in fine condition two years ago, but not one was put out in the field. Fortunately, however, a few capable men were found who carried out the instructions of the Department, but even then another difficulty was encountered, for when the lilies came in flower

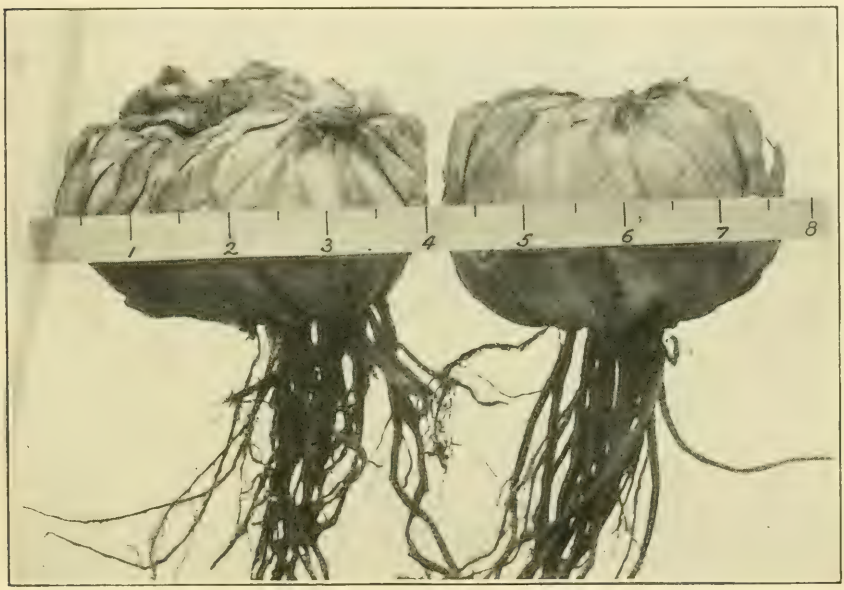

FIG. 2.—Two-year-old bulbs from seed of *Lilium longiflorum giganteum* ♀ × *L. l. harrisii* ♂, grown at Santa Ana, Cal.

twelve months after planting the seedlings the price offered by retail florists for the blooms was a temptation which few could resist. One florist cleared $250 in the spring of 1907 for flowers from seedlings on a space 25 by 45 feet, and this was only for the flowers he did not want for seed. The removal of flowers and stems, of course, results in bulbs of an inferior grade.

Those florists who have grown the seedlings for the bulbs alone are more than pleased with the results. This has been done in the vicinity of Santa Ana, where the soil and climatic conditions are evidently very favorable. Many of the bulbs harvested were of the 7 to 9 inch grade. Figure 2 shows two 2-year-old bulbs measuring nearly 11 inches in circumference, while figure 3 illustrates a bulb which in

three years from seed measured 14½ inches in circumference when harvested, grown at Santa Ana, Cal., by Mr. Edgar A. Metcalf. The bulbs secured from these sources force well, and being almost free from disease the loss on this account is small.

At Ventura, Cal., the conditions are extremely favorable for the production of strong, healthy growth, but the bulb mite put an end to the experiment in that section the second year. It should be men-

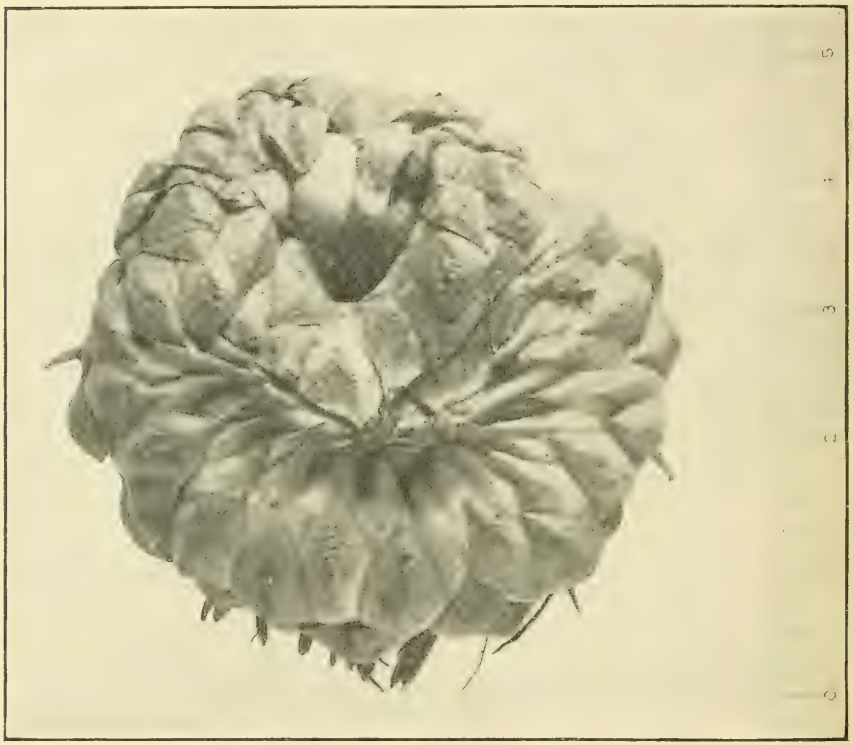

FIG. 3.—Bulb of *Lilium longiflorum giganteum* ♀ × *L. l. harrisii* ♂, three years from seed, weighing 434 grams and measuring 14½ inches in circumference when harvested, grown at Santa Ana, Cal. (Two-thirds natural size.)

tioned, however, that the soil in which the bulbs were planted had been used for calla lilies for several years.

At Longbeach, Cal., the growth made by the seedlings before planting out was very favorable, and probably a little distance from the shore in good soils the lilies would thrive well. At Yuma, Ariz., the growth made from mature bulbs planted for seeding promises well, and it is probable that the bulbs can be grown there to mature quite as early as those from the Bermudas.

In the extreme southern part of Texas the possibility of producing good bulbs would seem very encouraging, but the facilities for testing

have been anything but satisfactory. The farmers are men who grow crops on a large scale as a rule and a few hundred lilies are apt to receive but scant attention at critical periods, especially when staple crops are being attended to.

At Brownsville, Tex., one can see in the old Spanish gardens very healthy longiflorums in bloom during the first half of April. The growth is very strong and absolutely free from even a trace of disease. On January 15, 1907, some bulbs of the *harrisii* variety planted near Brownsville had made a strong growth, averaging 7 inches in height. These bloomed about the end of March and seeded fairly well.

Unfortunately, the temperature in the southeastern part of Texas is not very favorable, judging from the records supplied by the Weather Bureau. Some years the crop will turn out satisfactorily, but there always exists a danger of low temperatures, on account of which it would be unsafe to attempt cultivation on a large scale.

THE BEST VARIETIES TO GROW.

During the past three seasons in California the best success has been with seedlings which were obtained by crossing the red-stemmed *Lilium longiflorum giganteum* with *Lilium longiflorum harrisii.* (See Pl. I, and Pl. IV, fig. 1.) The progeny is remarkably strong and in some localities totally free from disease. In the open fields they come into flower about a week later than the true *harrisii.* These seedling lilies of the parentage mentioned are composed of four distinct types: Long-leafed and short-leafed green-stemmed plants, and long-leafed and short-leafed red-stemmed plants. All show a remarkable freedom of bloom. Mr. Fred. Rafferty, of Santa Ana, Cal., bloomed a large number of them in the spring of 1907. Although the seedlings were only about 3 inches high when planted out in June, 1906, some of them had 28 flowers to a single stem in June, 1907. This lot of seedlings is shown in Plates I and II. Two years ago at Ventura, Mr. S. Cole had some 2-year-old seedlings of the same cross, one of which had thirty-five flowers to a stalk. This plant is shown in Plate IV, figure 1.

On the farm of the Santa Ana Easter Lily Company during May, 1907, hundreds of plants had twenty or more flowers to a stem.

The only well-known variety which has been tried by the Department in California and Arizona is the *harrisii* variety from bulbs imported from Bermuda in 1906. These bulbs were planted in order to produce seed after being artificially pollinated. All of the stock grown turned out to be more or less diseased and most of the plants, although grown from good-sized bulbs, produced very poor flowers and a very low yield of seeds. A small lot of this variety grown from seed has turned out fairly well, but by this method of increase there are several distinct types, showing that it can not be

depended upon to produce plants true to the original type. It would seem, however, that many reliable growers in the East think there does not exist the same necessity for the *harrisii* variety as an early forcer as there was a few years ago when cold-storage bulbs were comparatively unknown for early forcing. If this is true, then there is but little need for haste in getting the *harrisii* variety into the American market, when in reality the bulbs should still be ripening in the fields. If the greenhouse men could use only the cold-storage supply for the production of flowers during the early part of the year, the fresh bulbs would then get an opportunity to ripen thoroughly before being taken from the ground. It would seem advisable to grow types from seed alone and propagate these for one or two seasons asexually, but only from bulbs and not by the scale method, using seeds instead of scales to increase the supply of bulbs. But when we have types which come absolutely true from seed there will be little likelihood of a necessity arising for saving even the smaller bulbs for replanting.

ADVANTAGES OF SEEDLINGS OVER PLANTS PRODUCED BY VEGETATIVE PROPAGATION.

The seedling method of propagation not only has its advantages in so far as the elimination of disease is concerned, but it is also a much quicker method than propagation from scales or even from small bulbs. The seedlings one year after planting very often show as many as twenty flowers to the stalk. During the past season (1907), as already stated, Mr. Fred. Rafferty, of Santa Ana, Cal., had seedlings with twenty-eight flowers. Such plants can be depended on to give bulbs of salable size the first year. Comparatively few of the 9 to 11 inch size are produced. The usual sizes are from 5 to 7 inches, but a considerable percentage of the 7 to 9 inch size is found in lots which have received good attention. The crop is ready for harvesting by the beginning of August. The smaller bulbs when replanted soon after being harvested grow much better than imported material.

THE SELECTION OF SEED BEARERS.

The seedlings now growing in California are principally crosses between the *harrisii* variety and the dark-stemmed variety of longiflorum known as *giganteum;* others are straight *harrisii* seedlings. The crosses are exceedingly vigorous and the *harrisii* plants are also more vigorous than the parents, but less vigorous than the crosses. The plants selected for bearing seed were apparently free from the disease, which manifests itself in spotted leaves, dwarfed growth, and distorted flowers.

In selecting ground for planting seed bearers it should be so arranged that lilies will not be grown on it for at least three years afterwards.

THE SELECTION OF SEEDLING TYPES FOR PROPAGATION.

The variations among the second generation seedling plants are easily recognizable. A batch of seedlings has usually four distinct kinds: Dark-stemmed (1) long-leafed and (2) short-leafed, and green-stemmed (3) long-leafed and (4) short-leafed. Three of these kinds are marked by tying on pieces of raffia, twine, and strips of rags, respectively, while the fourth series of plants remains unmarked. One kind is lifted at a time and kept separate for future propagation by division only, as it is scarcely worth while to employ the tedious method of scale propagation.

THE PREPARATION OF THE SOIL.

The preparation of the soil in the field should be attended to much in advance of the time the seedlings are ready to be planted out. If after a very heavy manuring a crop of potatoes or cabbage be taken from the ground, it will be in good order for the reception of the seedlings. In well-compacted soils a heavy crop of cowpeas or other legume deeply plowed under the previous summer should bring about good results. Immediately before planting, the soil should be worked by disking, rolling, and harrowing to make it smooth and easy to manipulate when putting in the seedlings.

BEDS VERSUS ROWS.

The question of growing the seedlings in prepared beds or in rows at equal distances apart in the field is important. The bed system requires hand work, while cultivation in rows 2 to 3 feet apart can be done with a horse machine. The beds have the following advantages: When the lilies are planted moderately close together, the foliage partly shades the ground and the lilies protect each other so that they are not likely to be whipped about by the wind; moreover, by the bed system more bulbs can be grown to the acre than in rows wide apart. The foliage of bed-grown plants is unquestionably of a deeper green than that of plants grown in rows. In irrigating, the sunken spaces or alleys separating the beds can be used to convey the water. In Bermuda the lilies are all grown in narrow beds and no irrigation is practicable, much to the detriment of the crop at times. Growing lilies in beds with hand cultivation is necessarily more expensive than in rows wide apart with horse cultivation, but it is likely to be found that the additional expense attending bed culture will be more than warranted by the returns, as this crop must not be viewed in the same manner as the ordinary field crops which yield $20, $40, or $100 to the acre. It is considered in Bermuda that an acre of lilies is not much of a success unless it yields from $1,000 to $2,000.

SIZE OF SEEDLINGS AT TIME OF PLANTING.

The seedlings at planting time are necessarily very small, having only a few very short and narrow leaves—in fact, they seem anything but promising—and to one who has not had experience in this line of work the appearance of the seedling plants would very naturally tend to discouragement. The rows in the bed should be about 8 inches apart, and the plants at least 5 inches. If the soil is loose and easily worked, they can be put in by hand; otherwise a short trowel is the handiest tool. Care should be taken not to have the seedling bed too wet at the time of transplanting, as this has a tendency to make the plants flabby. Water should be given as soon as they are put in the ground.

THE POLLINATION OF THE FLOWERS.

To insure the production of seed, the flowers must be artificially pollinated, as capsules are rarely formed without this operation. (Pl. IV, fig. 2.) The pollen is not scattered by wind to any extent and insects evidently visit the flowers without accomplishing a satisfactory transfer of pollen from the stamen to the stigmas; therefore recourse must be had to hand pollination. This consists in taking three or four stamens between the thumb and forefinger and rubbing the anthers, which are copiously supplied with pollen, against the viscid surface of the stigmas. It is best to transfer the pollen from the flowers of one plant to those of another, as the flowers then set seed better than when the pollen of one flower is transferred to the stigma of the same flower or to other flowers on the same plant.

The best time to select pollen is when the anthers have shrunk considerably and the pollen adheres to them in great masses. This should be applied to the stigmas shortly after the segments of the flowers open; the stigmatic surface will then be covered with a viscid substance which enables the pollen to adhere very easily. After pollinating the flowers on outdoor-grown plants it is advisable to cover them with paper bags. This is not necessary with plants grown in the greenhouse.

When the flower is ready for pollen it usually occupies a horizontal position, and when the pollen has performed its mission the capsule gradually assumes an upright position (Pl. IV, fig. 2), indicating that fertilization of the ovules has taken place. Not more than four capsules should be allowed to mature on one plant, as the production of seed seems to be a considerable drain on its resources.

The time required to ripen seed outdoors varies with the climatic conditions. In a greenhouse the seed ripens in about two months after

fertilization is effected. Those plants which set seed do not go to rest at the same period as those without seed capsules, but remain fresh and green for several weeks after the others have matured.

The ripening of the seed is indicated by the capsules turning from green to a light brownish color and splitting open at the top. They should then be gathered into a bag or box and spread out to dry. When dry the seeds should be removed from the capsules and stored in a cool, dry place until sown.

The plants selected for seed bearers should not be subjected to checks during the growing period. Water should be given when necessary and the ground cultivated as soon as possible afterwards. A mulch of very old stable litter helps to keep the soil cool and moist. Observance of these details will give the best seed-producing conditions; otherwise the capsules will not fill satisfactorily.

SOWING THE SEED.

The seed should be sown as soon as ripe, which is usually about the latter part of August or the beginning of September, in a place where close attention can be given to shading, ventilating, and watering. The method which has given most satisfaction in California is to sow the seed in well-prepared ground covered with a cloth house. (Pl. III, figs. 1 and 2.) This is easily and cheaply constructed, as a glance at the accompanying illustrations will show.

The roof should be high enough from the ground to provide plenty of space for a person to move around without stooping. The soil should be about 6 inches deep, on top of about 8 inches of stable manure. The bed should be raised above the surface of the ground 3 or 4 inches and edged with narrow boards a few inches above the paths; these will keep the soil in position and give a neat appearance.

The soil should consist of sandy loam mixed with screenings of dried horse manure, not for the purpose of enriching the soil, but to make it porous and easily worked. Fresh manure is injurious to the young plants. Make the surface of the beds level with a garden rake, sow the seed thinly, and press down with a piece of board. The seeds should then be covered with one-half inch of soil and cocoanut fiber in equal parts; ground redwood bark will answer the purpose quite as well, the idea being to keep the surface porous.

Water should be given through a fine sprinkler whenever the soil shows indications of becoming dry. The seeds should germinate in from three to six weeks. In April, or as soon as the weather will permit, the cloth may be removed gradually in order to harden off the young plants previous to planting out. The seeds may also be

sown in a frame built and covered so as to exclude sunshine and heavy rains while germination takes place; and while the plants are small care should be taken not to have the seed beds too wet at the planting-out period, as in this condition the seedlings are more easily wilted than otherwise when put in the field.

PRICKING OFF THE SEEDLINGS.

It is a question whether or not it pays to prick off the seedlings previous to planting in the open field. Judging from the behavior of most other crops so treated, one would suppose that it would be the best practice.

Those of the seedlings which were pricked off the past season undoubtedly showed stronger growth than those left in the seed beds till planting-out time, but it is claimed the operation does not show any beneficial effects on the plants a few weeks after being in the field. At any rate, there is much to be gained in thinning out the seedlings and pricking them off when they come up too thickly in the seed bed.

TEMPERATURE AND PRECIPITATION IN THE BERMUDAS.

For purposes of comparison with localities in the United States, the following table, showing the ranges of temperature and the precipitation at Prospect, Bermuda, for each month of the years 1900 to 1904, inclusive, will be of interest:

TABLE I.—*Temperature and precipitation at Prospect, Bermuda, from 1900 to 1904.*[a]

TEMPERATURE.

Year.		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1900	Maximum	73.4	73.4	71.8	74.2	78.4	83.0	91.2	89.8	88.6	82.6	78.6	75.8
	Minimum	53.0	50.6	48.6	49.6	56.8	61.8	67.2	68.8	59.2	64.8	59.4	53.6
1901	Maximum	71.8	70.4	73.0	74.0	83.2	88.0	92.4	93.6	91.0	87.8	74.8	74.0
	Minimum	49.2	46.8	51.4	40.4	58.6	64.0	72.0	73.0	71.4	62.2	53.8	55.0
1902	Maximum	71.6	72.0	74.2	79.8	81.2	83.6	89.4	90.0	87.4	83.8	78.0	75.0
	Minimum	49.2	48.0	49.0	55.0	59.4	63.0	67.8	67.8	69.2	62.2	62.2	54.8
1903	Maximum	74.8	74.2	74.0	74.4	76.2	84.0	90.0	90.8	90.0	81.8	77.0	76.0
	Minimum	54.2	51.0	57.0	57.2	59.6	61.4	67.4	70.2	70.0	61.6	57.4	49.8
1904	Maximum	73.4	73.2	75.4	77.4	80.6	84.4	86.4	88.0	88.0	83.4	77.0	74.0
	Minimum	46.2	45.6	50.4	53.6	60.0	65.6	68.4	69.0	67.0	64.6	53.6	54.0

PRECIPITATION.

1900	5.48	5.17	8.08	1.59	7.47	5.25	2.38	6.80	8.32	4.03	3.97	8.21
1901	9.71	5.56	8.55	7.20	1.83	1.54	2.42	2.27	1.92	10.52	7.82	3.33
1902	3.18	8.09	4.33	13.31	2.58	8.43	2.13	21.33	2.04	13.18	2.08	6.96
1903	4.37	1.44	4.06	4.20	3.98	3.83	1.73	3.85	8.38	9.83	5.03	10.58
1904	4.37	1.44	4.06	4.20	3.98	3.83	1.73	3.85	8.38	9.83	5.03	10.58

[a] Data supplied by the United States Weather Bureau.

The average normal temperature and precipitation at Hamilton, Bermuda, for each month of the years from 1900 to 1904, inclusive, follows:

TABLE II.—*Temperature and precipitation at Hamilton, Bermuda, from 1900 to 1904, inclusive.*[a]

TEMPERATURE.

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900–1904	62.0	61.5	62.2	63.9	69.4	75.0	78.4	79.6	77.4	73.0	68.7	64.7

PRECIPITATION.

1900–1904	4.94	4.44	5.13	4.18	4.66	5.95	4.44	6.08	6.51	6.71	4.38	4.49

[a] Data supplied by the United States Weather Bureau.

TEMPERATURE RECORDS OF THE LILY-GROWING LOCALITIES OF THE UNITED STATES.[a]

Fort Brown, Tex.—In the period from November, 1846, to December, 1903, at Fort Brown the annual mean was 73° F., the absolute maximum 102° F., and the absolute minimum 12° F. During the period from January, 1894, to December, 1903, with the records for several months missing, the temperature fell below 32° F. on sixty-six occasions. It would seem from these records that this vicinity would be unfavorable for growing the bulbs on a commercial basis.

Los Angeles, Cal.—The annual mean at Los Angeles from July, 1877, to December, 1903, is given as 62° F., the absolute maximum 109° F., and the absolute minimum 28° F. In the period from January, 1894, to December, 1903, the temperature fell below 32° F. on five occasions, viz, January 6, 1894; January 21, 1897; January 26 and 27, 1898; and December 13, 1901. This record was taken on roofs of the buildings of the Weather Bureau station 60 to 70 feet above the ground. Near the surface of the ground the maximum temperature is higher and the minimum considerably lower. However, in the foothills near Los Angeles frost is unknown, giving ideal conditions for lily farming.

San Diego, Cal.—At San Diego the annual mean temperature in the period from 1850 to 1903 was 61° F., the absolute maximum 101° F., the absolute minimum 32° F. During the period from January 1, 1894, to December 31, 1903, the temperature fell to 32° F. on one occasion—January 7, 1894.

Santa Barbara, Cal.—At Santa Barbara the annual mean temperature in the period from January, 1881, to December, 1903, was 60° F.,

[a] Data obtained from Bulletin Q of the United States Weather Bureau.

the absolute maximum 100° F., and the absolute minimum 28° F. During the period from January, 1897, to December, 1903, the temperature fell below 32° F. on only three occasions—December 20, 1897, February 6, 1899, and February 3, 1903. The foothill region close to Santa Barbara is practically frostless. Here we find specimens of tropical plants such as Anthuriums and Platyceriums growing out of doors all the year round; also large specimens of tropical trees such as the mango, Casimiroa, and avocado. In these places the growth of Easter lilies is continuous through the winter, and the plants flower from one to two weeks earlier than on the level ground nearer the sea.

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PLATES.

DESCRIPTION OF PLATES.

PLATE I. Field of hybrid Easter lily seedlings (*Lilium longiflorum giganteum* ♀ × *L. l. harrisii* ♂) twelve months after planting, coming into flower. These lilies were grown by Mr. Fred. Rafferty, Santa Ana, Cal., from seed supplied by the Bureau of Plant Industry. Seed sown October, 1905. Planted in the field April 30, 1906. Photographed May 30, 1907.

PLATE II. The same field shown in Plate I in bloom, after three-fourths of the flowers had been cut. Photographed June 20, 1907.

PLATE III. Raising Easter lilies at Santa Ana, Cal. Fig. 1.—Cloth house used at Santa Ana, Cal., by Mr. Fred. Rafferty in raising seedling lilies previous to planting in the field. Imported *Lilium longiflorum harrisii* plants are seen on the right. Fig. 2.—Interior of cloth house shown in figure 1, containing 100,000 seedling lilies ready for the field.

PLATE IV. Hybrid Easter lilies. Fig. 1.—Two-year-old hybrid Easter lily plant (*Lilium longiflorum giganteum* ♀ × *L. l. harrisii* ♂) with 35 flowers, grown at Ventura, Cal., by Mr. S. Cole. Fig. 2.—Capsules and seeds of *Lilium longiflorum harrisii* × ♀ *L. longiflorum* ♂.

FIELD OF HYBRID SEEDLING EASTER LILIES COMING INTO FLOWER TWELVE MONTHS AFTER PLANTING AT SANTA ANA, CAL.

THE SAME FIELD SHOWN IN PLATE I IN BLOOM, AFTER THREE-FOURTHS OF THE FLOWERS HAD BEEN CUT.

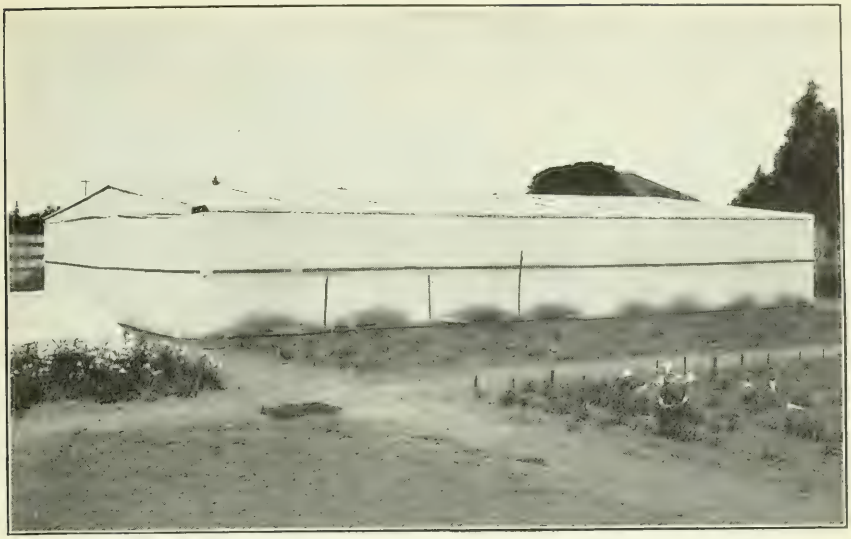

FIG. 1.—CLOTH HOUSE USED IN RAISING SEEDLINGS PREVIOUS TO PLANTING IN THE FIELD.

FIG. 2.—INTERIOR OF CLOTH HOUSE SHOWN IN FIGURE 1, CONTAINING 100,000 SEEDLINGS READY FOR THE FIELD.

RAISING EASTER LILIES AT SANTA ANA, CAL.

Bul. 120, Bureau of Plant Industry, U. S. Dept. of Agriculture.

FIG. 1.—TWO-YEAR-OLD HYBRID EASTER LILY PLANT WITH 35 FLOWERS GROWN AT VENTURA, CAL.

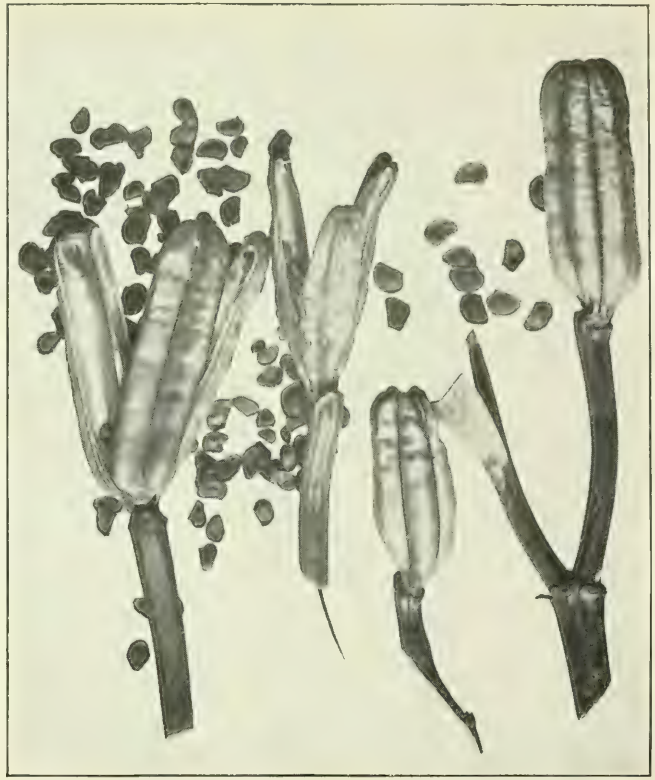

FIG. 2.—CAPSULES AND SEEDS OF LILIUM LONGIFLORUM HARRISII × L. LONGIFLORUM.

HYBRID EASTER LILIES.

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